PREDICT-6G

A quick overview

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Funded by
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What is deterministic?

Reliable

- Availability
- Low packet low
- Failure resilient

Time sensitive

- Bounded latency
- Low jitter

Predictable

- Use AI for predicting events, states, demand, resources
- Autonomous pro-active actions based on predictions

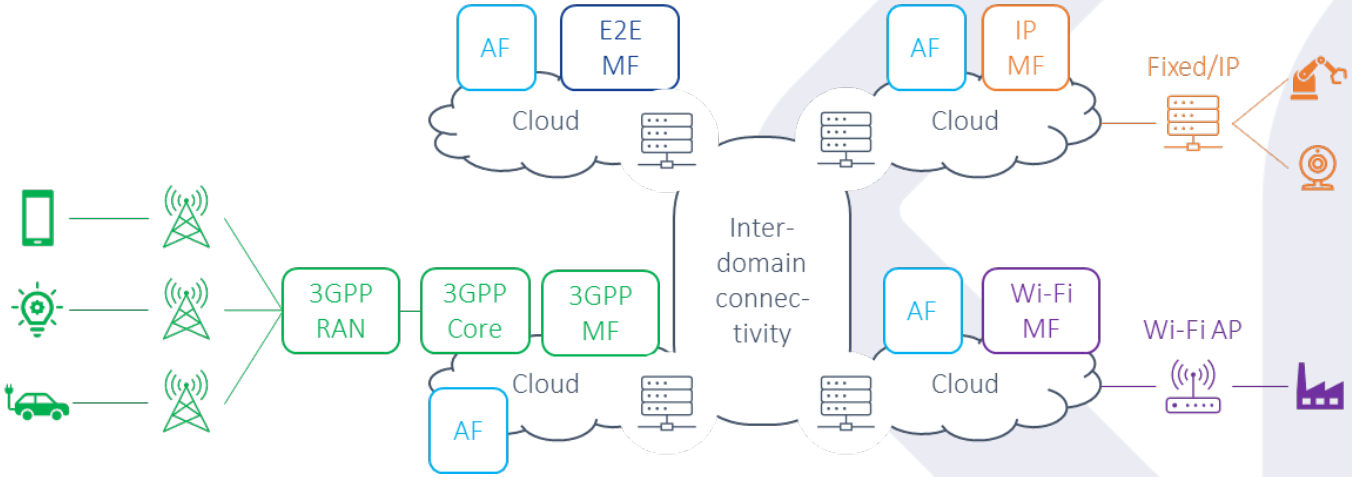
Project mission

- Design, create and validate e2e 6G solutions providing deterministic services over multiple inter-connected domains and technologies (incl. wired and wireless)
  - integration, abstraction and programmable exposure of multiple U-plane mechanisms (with different levels of intrinsic deterministic capabilities)
  - AI/DT based C/M-plane mechanisms (autonomous orchestration and assurance of e2e deterministic services)
- Output
  - Reference architecture
  - Protocols, APIs (U/C-plane)
  - Management and automation techniques
  - PoC
  - Standard contributions and publications

High-level project objectives

- Define a deterministic (reliable, time sensitive, and predictable) multi-technology, multi-stakeholder network. Provide the PREDICT-6G network architecture based on the analysis of relevant use cases, evaluating its potential business impact (WP1)
- Design the PREDICT-6G Multi-technology, multi-domain Data-Plane (MDP) (WP2)
- Provide a novel AI-based control-plane framework (AICP) to enable determinism in multi-stakeholder multi-technology 6G environments (WP3)
- Integration, experimentation and use case verification (WP4)
- Disseminate and communicate project results to the broadest audience using Open Science practices, impact standards and European ecosystem, and exploit project outcomes (WP5)

Overview of the technology domains and the environment targeted by PREDICT-6G – high-level MDP architecture



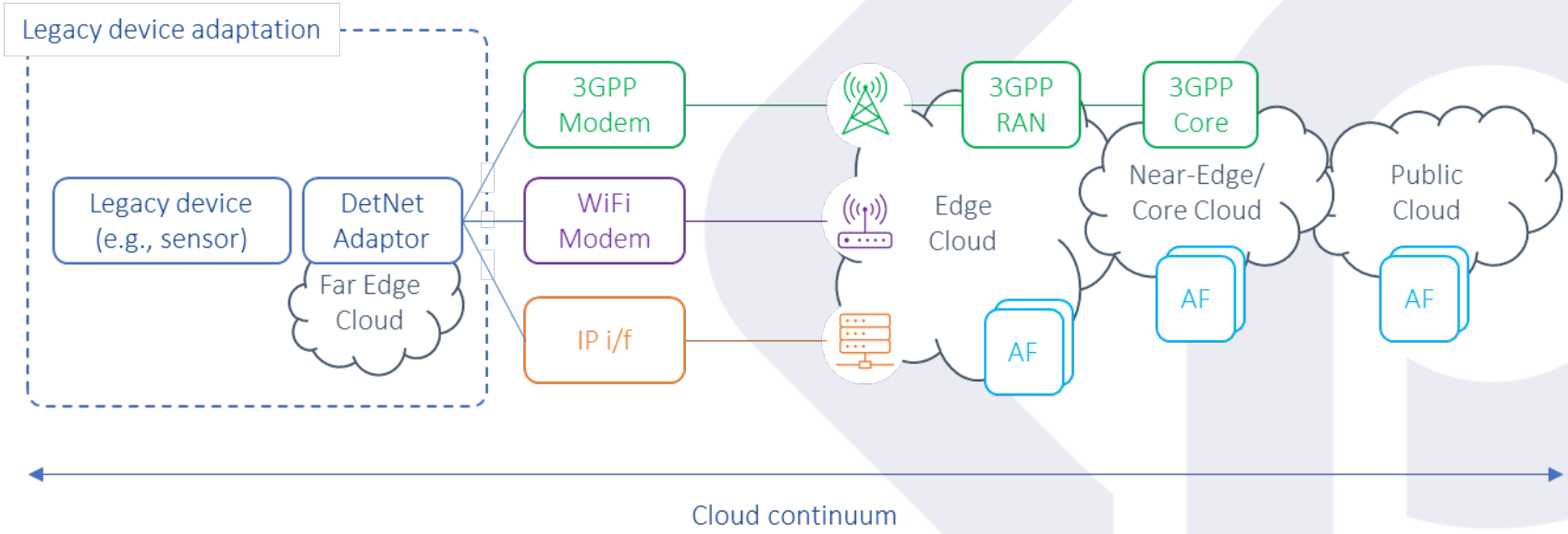
- 3GPP TSC Rel19
- Wi-Fi 7/8
- IEEE 802.1 TSN
- DetNet, RAW

MF – Management Function (e.g., network/domain controller)

– Systems/Domains with different deterministic networking capabilities

AF – AI/Application Function (e.g., data analyzer, robot controller, X-as-a-Service)

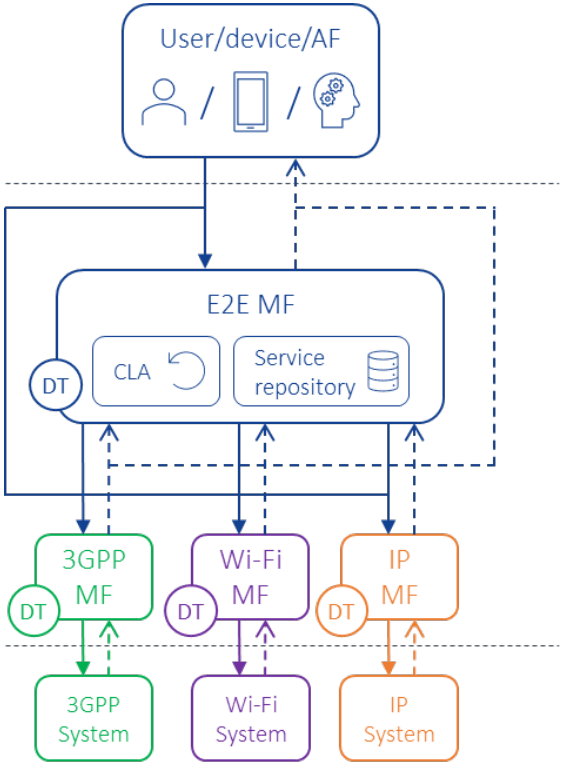
Deployment of PREDICT-6G over the edge-cloud continuum supporting legacy devices with no deterministic capabilities



DetNet Adaptor

- Implements interfaces (APIs) to Management Functions (E2E MF, domain/system specific MF)
- Implements user plane DetNet capabilities (packet scheduling, pacing, segmentation, etc.)

The high-level AICP architecture of PREDICT-6G



Inter-System/Domain interfaces (APIs) to configure/negotiate E2E deterministic service requirements

System/Domain specific interfaces (APIs) to deploy and assure system/domain specific deterministic services

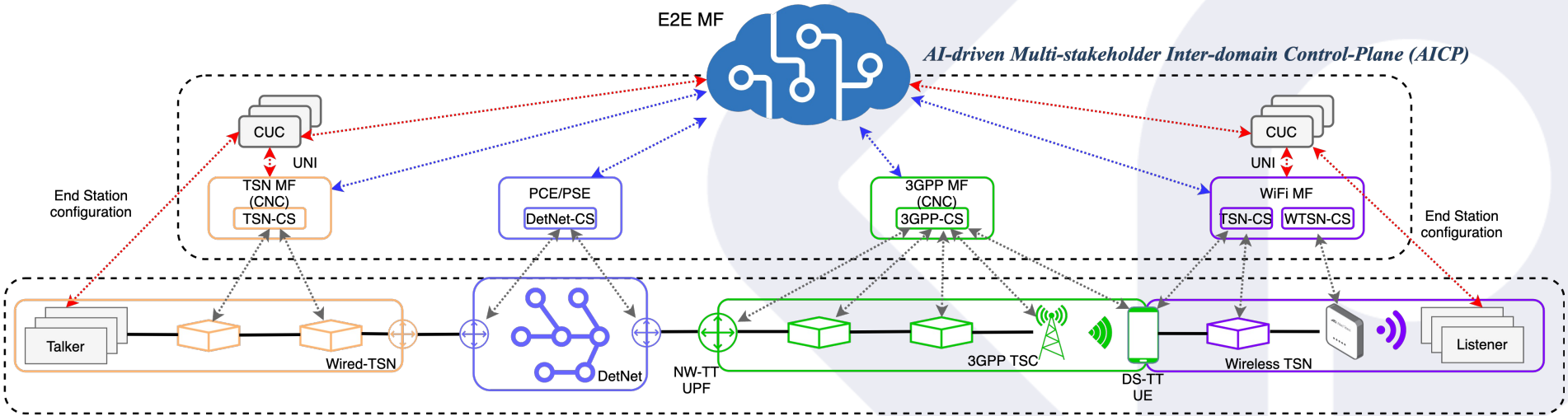
Request / configuration

Measurement / status / insight

CLA – Closed Loop Automation

DT – Digital Twin

Integration example between the MDP and AICP



CNC: Central Network Controller - Domain specific MF
NW-TT: Network Side TSN Translator
DS-TT: Device Side TSN Translator
CUC: Central User Control
UNI: User-Network Interface
PCE: Path Computation Entity
PSE: Path Selection Engine

Ambitions

Innovation areas

Topic 1: Cross-domain E2E deterministic service management automation.

- Vertical integration: programmability and observability by a service layer
- Horizontal integration: how to e2e with other domains (especially using both wired and wireless segments)

Topic 2: Emulate deterministic network capabilities on top of non-deterministic network segments

- AI based profiling and prediction of network events, states, demand, available resources and impact of actions in the context of deterministic services

Topic 3: Predictability through Network Digital Twinning

- Accurate DT for wireless and wired network segments and their interactions
- DT for modelling determinism

Ambitions – cont'd

Innovation areas

Topic 4: User, resource, and function mobility under deterministic constraints

- Types of mobility: (i) device/user; (ii) resource/service function chaining; (iii) VNF migration
- Specific challenges in deterministic network context

Topic 5: Highly configurable monitoring platform for multi-technology deterministic networks

- Data collection (scalable, flexible, efficient, extendible, etc.)
- Support AI/ML integration

Topic 6: Improvement of L2 deterministic capabilities of IEEE 802.11 and 3GPP

- Adopt technologies from IEEE 801.1AS and apply them on the radio L2 of IEEE and 3GPP

Topic 7: Data-plane integration of multiple deterministic and non-deterministic domains

- Extend the RAW and DetNet efforts to multiple deterministic domains

Use case 1: Smart manufacturing

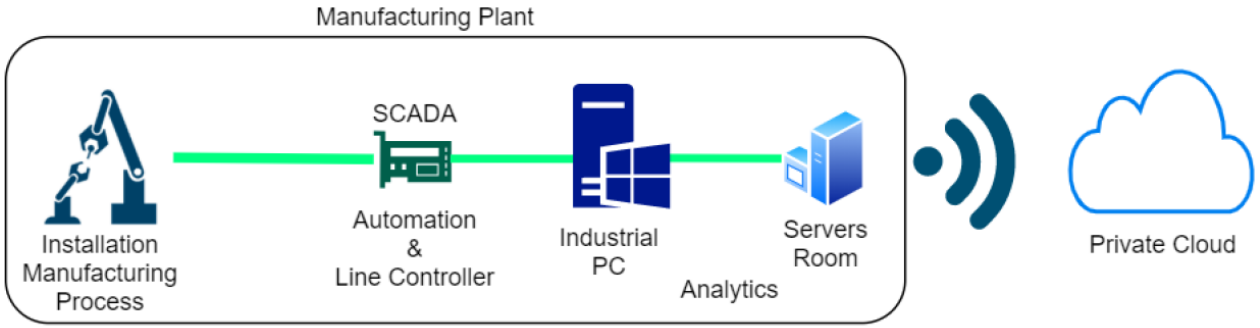
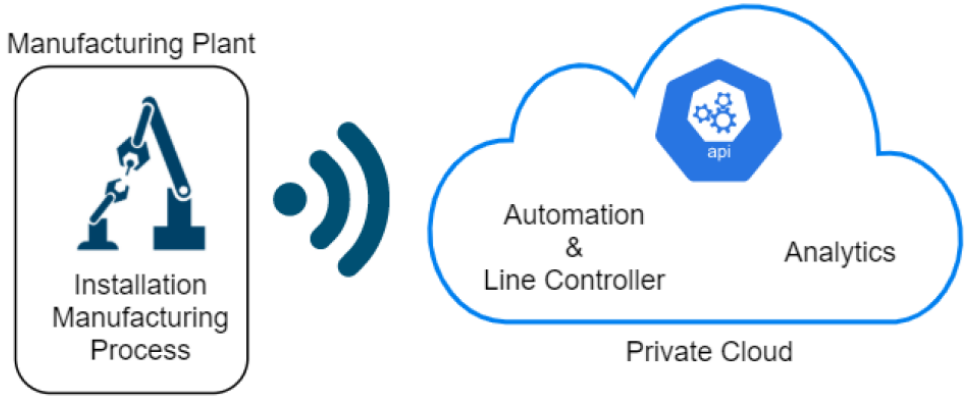
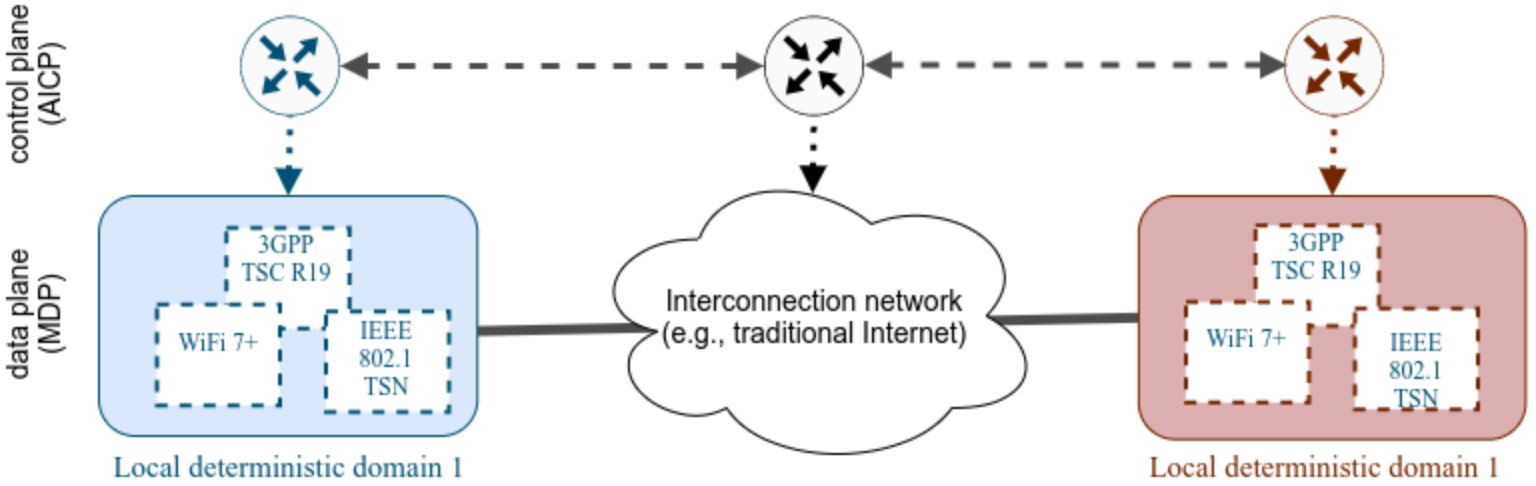


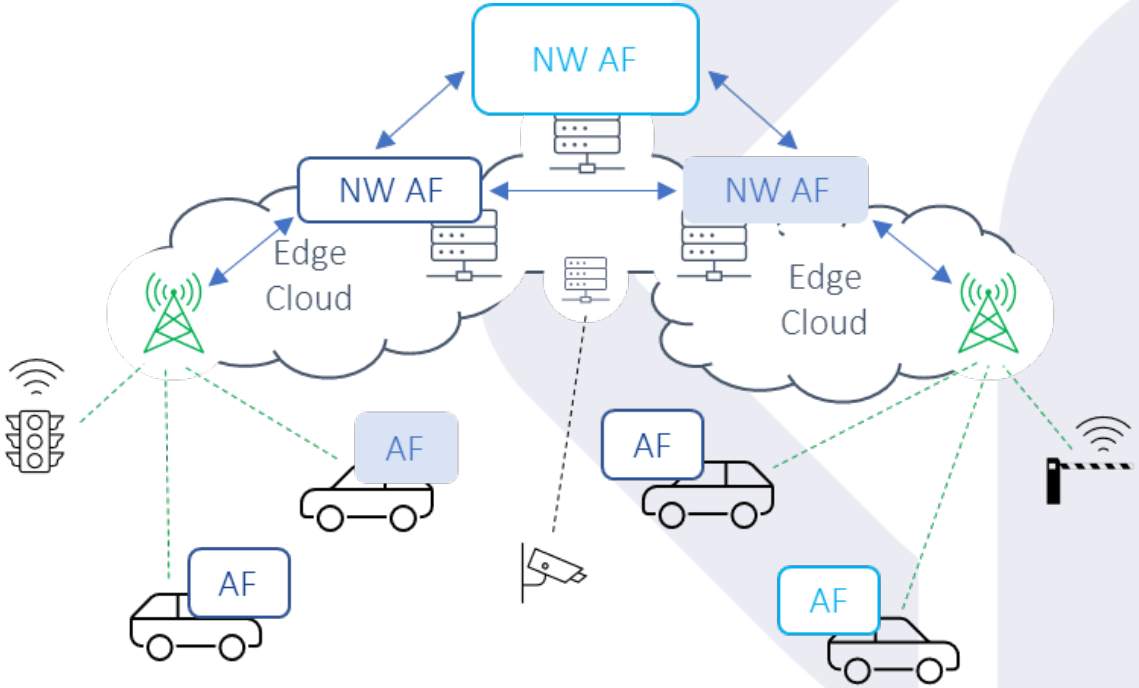
Figure 1-17: Current network architecture in manufacturing plants



Use case 2: Large-scale multi-domain deterministic network



Use case 3: Critical communications



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Thank you!

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